

Appl. No. 10/718,913
Reply to Office Action of July 12, 2005

Docket No. MIT-152AUS

Amendments to the Claims:

This listing of the claims will replace all prior versions, and listings, of the claims in the application:

- 1 1. (Original) A powered orthotic device for augmenting a person's muscular functionality
2 comprising:
3 a brace adapted to be coupled to a body part of the person and having a length such that
4 the brace traverses a joint of the person, said brace including at least one strap for attaching the
5 brace to the body part of the person;
6 sensing means, fixed in at least one of the at least one straps such that when said strap is
7 coupled to the body part said sensing means is coupled to at least one muscle of the person and
8 wherein in response to the person attempting to move the body part, said sensing means senses a
9 surface electromyographic (EMG) signal of the muscles connected to the joint and determines a
10 desired joint torque from the EMG signal and provides a sensor signal in response thereto; and
11 an actuator coupled to receive the sensor signal from said sensing means and in response
12 to the sensor signal said external actuator provides a force having a magnitude which is
13 proportional to a magnitude of the sensor signal provided by said sensing means and wherein the
14 ratio of power delivered by said actuator to the mass of the actuator takes into account all of the
15 elements needed to generate the force.
- 1 2. (Original) The device of Claim 1 further comprising:
2 means for receiving the sensor signal and for scaling the sensor signal by a variable
3 amount; and
4 an active feedback control loop circuit coupled to control the amount of force applied to
5 the joint by said external actuator.
- 1 3. (Original) The device of Claim 2 wherein said active feedback control loop circuit further
2 comprises means for providing a measurement of output torque to ensure an accurate application
3 of force.
- 1 4. (Original) The device of Claim 3 further comprising:

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2 a cable drive coupled between said actuator and said brace such that in response to
3 movement of the actuator, said cable drive moves the brace.

1 5. (Original) The device of Claim 4 further comprising a wheelchair wherein:
2 at least a portion of said cable drive system is coupled to said wheel chair; and
3 said actuator is disposed such that the mass of said actuator is substantially supported by
4 said wheelchair.

1 6. (Original) The device of Claim 1 wherein said actuator corresponds to an electric actuator.

1 7. (Original) The device of Claim 1 wherein said actuator corresponds to a hydraulic actuator
2 which comprises a compressor and wherein the ratio of power delivered by said actuator to the
3 mass upon which the actuator acts is selected to be above a predetermined threshold level..

1 8. (Original) The device of Claim 1 wherein said actuator corresponds to a pneumatic actuator
2 which comprises a compressor and wherein the ratio of power delivered by said actuator to the
3 mass upon which the actuator acts is selected to be above a predetermined threshold level. .

1 9. (Currently Amended) A powered orthotic device for augmenting a person's muscular
2 functionality comprising:
3 a brace adapted to be coupled to a body part of the person and having a length such that
4 the brace traverses a joint of the person;
5 sensing means coupled to at least one muscle of the person wherein in response to the
6 person attempting to move the body part, said sensing means noninvasively senses a desired
7 muscular force of the person and provides a sensor signal in response thereto;
8 an external actuator coupled to receive the sensor signal from said sensing means and in
9 response to the sensor signal said external actuator provides a force having a magnitude which is
10 proportional to a magnitude of the sensor signal provided by said sensing means wherein the a
11 ratio of power delivered by said actuator to the mass of the actuator takes into account all of the
12 elements of the powered orthotic device needed to generate the force; and
13 a control means coupled to said external actuator, said control means including means for
14 making a low impedance measurement of output torque and for providing a feedback signal to

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15 said external actuator to ensure an accurate application of the force provided by said external
16 actuator.

1 10. (Currently Amended) The powered orthotic device of Claim 910 wherein: said brace
2 comprises a hinge mechanism having first and second hinge portions and first and second straps
3 coupled to respective ones of the first and second hinge portions wherein said first and second
4 hinge portions allow the first and second straps to move relative to each other in accordance with
5 normal movement of a joint which the brace traverses and wherein the device further comprises:
6 a cable wheel coupled to said brace, said cable wheel having a groove;
7 a continuous cable coupled to said cable wheel, said continuous cable disposed around
8 the cable wheel within the groove wherein said continuous cable is retained on one of ~~he~~ the first
9 and second straps such that when the cable is moved, the cable wheel rotates, causing the first
10 and second straps to move relative to each.

1 11. (Previously Presented) A powered orthotic device for augmenting a person's muscular
2 functionality comprising:
3 a brace adapted to be coupled to a body part of the person and having a length such that
4 the brace traverses a joint of the person, said brace comprising first and second straps;
5 a cable wheel coupled to said brace, said cable wheel having a groove;
6 a continuous cable coupled to said cable wheel, said continuous cable disposed around
7 the cable wheel within the groove wherein said continuous cable is retained on the second strap
8 such that when the cable is moved, the cable wheel rotates, causing the first and second straps to
9 move relative to each other.

1 12. (Previously Presented) The powered orthotic device of Claim 11 wherein said brace
2 comprises;
3 a hinge mechanism having first and second hinge portions; and
4 first and second straps, each of said first and second straps coupled to a respective one of
5 said first and second hinge portions which allow the first and second straps to move relative to
6 each other in accordance with normal movement of the joint which the brace traverses.

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1 13. (Previously Presented) The powered orthotic device of Claim 12 wherein said hinge
2 mechanism includes adjustable physical stops or locks which can limit the range of movement of
3 the first strap relative to the second strap.

1 14. (Previously Presented) The powered orthotic device of Claim 11 wherein said cable wheel
2 is provided having a groove and said continuous cable is disposed around the cable wheel within
3 the groove.

1 15. (Previously Presented) The powered orthotic device of Claim 11 further comprising a cable
2 retainer disposed to retain said continuous cable on the second strap.

1 16. (Previously Presented) The powered orthotic device of Claim 11 wherein said cable 26 is
2 provided having an inner cable portion 26a, which, along certain portions of the cable 26, is
3 surrounded by an outer cable jacket 26b, through which the inner cable portion 26a can slide.

1 17 (Previously Presented) The powered orthotic device of Claim 11 further comprising an
2 actuator coupled to said cable said actuator having force feedback control, which provides the
3 movement of the cable.

1 18. (Previously Presented) The powered orthotic device of Claim 17 further comprising a power
2 source coupled to said actuator.

1 19. (Previously Presented) The powered orthotic device of Claim 17 wherein the power source
2 corresponds to the power source of a wheel chair.

1 20. (Previously Presented) The powered orthotic device of Claim 11 further comprising a sensor
2 disposed to sense signals generated by a person wearing the orthotic device.